Apr 27th, 12:00 AM - 12:00 AM

Using Experimental Auctions to Examine Teen Demand for JUUL

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Background

- Cigarette smoking is the leading cause of preventable disease and mortality in the US, generally, a habit that starts during adolescence
- Cigarette smoking is on the decline; 85.7% of high school seniors disapproved of pack a day smoking in 2018 (Johnston, et al., 2019)
- Teen e-cigarette usage has risen drastically in recent years; prevalence in high school seniors went from nearly 0% in 2011 to 37% in 2018 (Johnston, et al., 2019)
- JUUL is by far the most popular e-cigarette brand (Ali et.al. 2020)

Background (cont.)

- Marketing directed towards teens could result in a higher demand among teens than other vape products (Turner 2020)
- Users consider JUUL style vapes “less harmful to health” and more aesthetically pleasing (Keamy-Minor, McQuoid, & Ling, 2019)
- Also more dangerous as they deliver nicotine in high concentrations relative to other vape styles (Keamy-Minor, McQuoid, & Ling, 2019)

- Prior literature estimating demand has focused little attention directly on demand for **JUUL/other pod-style brands** or **susceptibility**

Literature Review

- Nicotine levels influence willingness to pay (“WTP”) for cigarettes (Monchuk et. al. 2006)
- Online survey determined 63% of cigarette smokers said e-cigs are substitutes (37% said they were compliments) (Doyle et al. 2015)
- Health concerns of cigarettes could reduce demand among adult dual users (Marti et. al. 2016)
- Cigarette smokers have demand for e-cigarettes especially in reusable forms (O’Connor et. al. 2017)

Literature Review (cont.)

- JUUL:
  - A 10% increase in price leads to 24% reduction in JUUL demand among teen nicotine users (Corrigan, et al., 2020)
  - Youth perceive flavored JUUL and vapes to have less negative health impacts (Strombotne, et. al., 2021)
- Susceptibility:
  - Defining Susceptible smoker; determining exposure to other smokers would cause a non-user to become a user (Pierce et. al., 1996)
  - Susceptibility is a strong predictor of future e-cigarette use (Bold et. al., 2016)

Methodology: Auction Mechanism

- 18/19-year-old students from University of South Carolina (N=188)
  - October 2018 through March 2019
  - 45% nicotine users (used cigarette or e-cigarette in past 30 days)
  - 77% susceptible (susceptible user defined as someone who did not say "definitely not" if offered nicotine product by a friend and when asked if they see themselves using nicotine products within the year)
- Experimental Auctions used to estimate demand (Lusk & Shogren, 2007)
- Participants received $20 for participation and $10 to use in auction

Methodology: Auction Mechanism (cont.)

- Participants bid on 9 random products varying in product type (vape, heat stick, cigarette), flavor (tobacco, cherry, menthol), and nicotine level (high, medium, low), as well as control products (vape, $5 Starbucks gift card, and JUUL starter pack)
- Participants were first screened to prove their age was 18-19 and were grouped into their user category
- Participants completed a survey – version depended on their user category – about their smoking/vaping habits and perceptions towards certain products or habits

Methodology: Auction Mechanism (cont.)

- Participants were briefed on the **Becker-DeGroot-Marsvhak (BDM) auction mechanism** (Becker, DeGroot and Marschak 1964)
- Participants choose a bid from $0-10 in $0.10 increments for each product; one of the items were then selected by experimenter
- A random bid from a random distribution ($0.00-$10.00) was chosen
- If a participants bid for the item was ≥ random price, they buy the product, pay the random price, and kept the reminder of the $10
- If a participants bid for the item was ≤ random price, they did not buy the product, but kept the entire $10

Methodology: Auction Mechanism (cont.)

- Since a participant's bid cannot influence the price they pay if they win (winner pays the random price), they have no incentive to deviate from their true value while placing their bid
- Participants cannot bid low in hopes of getting a better deal
- BDM auctions are demand revealing
- Participants next place bids in a hypothetical practice auction for one of three six-month magazine subscriptions to see how the auction will work

Methodology: Auction Mechanism (cont.)

- Participants then bid on the 12 products in the auction (9 random products followed by 3 control products)
- The product to be sold was then determined, a random price was chosen, and all participant's bids' were compared to the random price to determine any winners
- Participants lastly participated in a demographic survey and all winners made their final transactions before finishing

Methodology: OLS Regression

- The regressions equations for these three dependent variables 1) ***[JUUL Bid – Maximum Cig Bid]*** 2) ***[JUUL Bid – Maximum Vape Bid]*** 3) ***[Maximum Vape Bid – Maximum Cig Bid]*** become:

$$(1)\ JBMMCB_i = \alpha_i + \beta_1 USER_i + \beta_2 SUS_i + \beta_3 RACEW_i + \beta_4 MALE_i + \varepsilon_i$$

$$(2)\ JBMMVB_i = \alpha_i + \beta_1 USER_i + \beta_2 SUS_i + \beta_3 RACEW_i + \beta_4 MALE_i + \varepsilon_i$$

$$(3)\ MVBMMCB_i = \alpha_i + \beta_1 USER_i + \beta_2 SUS_i + \beta_3 RACEW_i + \beta_4 MALE_i + \varepsilon_i$$

- Other Independent variables:
  - USER = Dummy Variable, 1= User and 0=Nonuser (User defines as someone who has used a nicotine product in the past 30 days – either cigarette or e-cigarette/vape)
  - SUS = Dummy Variable, 1=Susceptible to Smoke or Vape and 0=Not Susceptible to Smoke or Vape (susceptibility defined as someone who did not say “definitely not” if offered nicotine product by a friend and when asked if they see themselves using nicotine products within the year)
  - RACEW = Dummy Variable, 1= Race white (not a racial minority) and 0=Otherwise
  - MALE = Dummy Variable, 1=Male and 0=Otherwise

Methodology: Why Max Bid and Differences?

- Using the participant's maximum bid for each product type allows us to have more relevant data as it controls for participant's tastes and preferences (Rousu and Kosa 2005)

- The dependent variables are all differences between two bids – This is to prevent any potential coefficient bias caused by any undetected correlation of bids since they were restricted between $0-10 (Huffman et. al. 2003)
  - A Censored TOBIT model was used in an earlier version of this paper and yielded similar results

Table 1

Using Experimental Auctions to Examine Teen Demand for JUUL

Dependent Variable: JUUL Bid Less Maximum Cig Bid (JBMMCB)				
	(1)	(2)	(3)	(4)
Constant	-0.292	-0.227	-0.825	-0.742
	[0.563]	[0.394]	[1.139]	[1.072]
USER	1.913	2.337		1.974
	[3.193]***	[4.280]***		[3.270]***
SUS	1.217		1.994	1.013
	[1.802]*		[3.07]***	[1.441]
RACEW		0.644	0.836	0.594
		[1.152]	[1.409]	[1.064]
MALE		0.412	0.390	0.291
		[0.737]	[0.67]	[0.507]
N	188	183	183	183
Adjusted R^2	0.100656	0.113239	0.100656	0.103332
Prob(F-statistic)	11.46471	7.619397	0.00002	0.000101

Notes: Each variable provides an estimated coefficient & [absolute value of the t-statistic] ; Least Squares were used ; Statistical significance for the 1 = ***, 5 = **, and 10 = * are noted

Table 1 Results:

- Regression results for difference between JUUL and Cig Demand
  - Coefficient estimates show how changes in the independent variables impact the participant's WTP for JUUL relative to cigarettes

- Specification 1 shows Users and Susceptible Non-Users have a significantly higher demand for JUUL than cigarettes (Specifications 2 and 3 confirm)
  - User: ($1.91 - $2.34 higher)
  - Susceptible: ($1.22 - $1.99 higher)

- Specification 4 shows Susceptible Non-Users are marginally insignificant

Table 2

Using Experimental Auctions to Examine Teen Demand for JUUL

Dependent Variable: JUUL Bid Less Maximum Vape Bid (JBMMVB)				
	(1)	(2)	(3)	(4)
Constant	-0.411	-0.572	-1.038	-0.948
	[0.809]	[1.009]	[1.446]	[1.384]
USER	2.017	2.407		2.142
	[3.548]***	[4.645]***		[3.827]***
SUS	0.939		1.804	0.739
	[1.440]		[2.830]***	[1.102]
RACEW		-0.047	1.257	0.994
		[0.090]*	[2.176]***	[1.842]*
MALE		1.031	-0.027	-0.135
		[1.923]	[0.050]	[0.253]
N	188	183	183	183
Adjusted R^2	0.105212	0.12843	0.079809	0.12958
Prob(F-statistic)	11.99401	9.939518	5.174912	7.773594

Notes: Each variable provides an estimated coefficient & [absolute value of the t-statistic] ; Least Squares were used ; Statistical significance for the 1 = ***, 5 = **, and 10 = * are noted

Table 2 Results:

- Regression results for difference between JUUL and Vape Demand
  - Coefficient estimates show how changes in the independent variables impact the participant's WTP for JUUL relative to e-cigarettes/vapes
- Specification 1 shows Users have a significantly higher demand for JUUL than e-cigarettes (Specification 2 confirms – adding that race plays a small role)
  - User: ($2.02 - $2.41 higher)
- Specification 3 shows that Susceptible Non-User (and white) participants both also have a significantly higher demand for JUUL than e-cigarettes
  - Susceptible: ($1.80 higher)
- Specification 4 shows Susceptible Non-Users are marginally insignificant

Table 3

Using Experimental Auctions to Examine Teen Demand for JUUL

Dependent Variable: Maximum Vape Bid Less Maximum Cig Bid (MVBMMCB)				
	(1)	(2)	(3)	(4)
Constant	-0.773	-0.940	-0.564	-0.630
	[2.926]***	[2.821]***	[1.268]	[1.513]
USER	-1.453	-1.796		-1.578
	[3.564]***	[4.768]***		[3.821]***
SUS	-0.726		-1.393	-0.608
	[1.899]*		[3.807]***	[1.589]
RACEW		-0.394	-0.557	-0.364
		[1.171]	[1.584]	[1.088]
MALE		0.143	0.137	0.216
		[0.396]	[0.361]	[0.587]
N	188	183	183	183
Adjusted R^2	0.117784	0.124392	0.054708	0.127883
Prob(F-statistic)	13.48309	9.618515	4.51104	7.671871

Notes: Each variable provides an estimated coefficient & [absolute value of the t-statistic] ; Least Squares were used ; Statistical significance for the 1 = ***, 5 = **, and 10 = * are noted

Table 3 Results:

- Regression results for difference between Vape and Cig Demand
  - Coefficient estimates show how changes in the independent variables impact the participant's WTP for e-cigarettes/vapes relative to cigarettes

- Specification 1 shows Users and Susceptible Non-Users have a significantly lower demand for e-cigarettes/vapes than cigarettes
  (Specifications 2 and 3 confirm)
  - User: ($1.45 - $1.80 lower)
  - Susceptible: ($0.73 - $1.40 lower)

- Specification 4 shows Susceptible Non-Users are marginally insignificant

Discussion (Public-Health Viewpoint)

It was found that:

(1) There is a higher teen demand for JUUL relative to other cigarette & e-cigarette products

- E-cigarettes/Vapes/JUULs are replacing cigarettes for cigarette users
  - Teens who are not current users – Non-Users – would not have a higher demand for the e-cigarette/vapes, if this were the case
  - While cigarette alternatives are not as harmful as cigarettes, they are still a lot worse than not using nicotine products at all

(2) There is modest evidence that susceptibility plays a role in teen demand for nicotine products

- Susceptible Non-Users have a higher demand for JUUL than other products. This indicates a negative factor for JUUL
  - Teens who are not as susceptible to smoking cigarettes may start using a JUUL, which is better than smoking but has negative health effects relative to not using nicotine products

Policy Implications (Public-Health Viewpoint)

- We don’t want Non-Users to start using nicotine products but rather want to see people switch from cigarettes to e-cigarette/vape/JUUL alternatives (generally seen as less harmful)
  - This is the case when Susceptible Non-Users have a higher demand for JUUL than cigarettes (The demand is expected to be equal)

- Include graphic warning labels on JUUL packaging, which has been shown to reduce demand for cigarettes (Thrasher, et. al. 2011)
  - Future research with graphic warning label impact on JUUL demand should be conducted

Thank you – Questions?

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